PEN&PAD(Elderly Care): Designing a Patient Record System for Elderly Care

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ABSTRACT

Practical experiences in the work analysis and design of a computer-based patient record system for use by doctors on an elderly care ward are discussed. A diagrammatic technique named "Task Oriented Flow Diagrams" is briefly described. This technique enables designers to formalise their understanding of users work tasks in manner that is comprehensible to users, and thus can form the basis of a dialogue between designer and users. A prototype patient record system is described and the results of its evaluation with users presented.

INTRODUCTION

The PEN&PAD (Elderly Care) Project is a research programme which seeks to investigate the requirements of a computer-based patient record system for the shared care of the elderly in a hospital environment. The goal of the project is to illustrate how a single, integrated information system can be both useful and usable by the different practitioner groups involved in elderly care (doctors, nurses, physiotherapists and occupational therapists). A previous paper proposed a collaborative architecture which showed how the different perspectives of practitioner groups may be supported by providing alternative views on a single, unified underlying patient record [1].

This paper discusses practical experiences in the work analysis and design stages of the project which led to the development and evaluation of the first prototype system for doctors on the elderly care ward. A nursing prototype has also been developed in parallel using the same approach. This is described in detail elsewhere [2].

The project philosophy emphasizes User Centred Design, making potential users central to the design and development process. The paper begins by outlining the work analysis and design methodology used. In particular, it describes the diagrammatic technique for representing users work tasks which was developed within the project, and the use of this technique as a means of communication between designers and users. We highlight the gap between work analysis and design stages and discuss how these two stages are performed iteratively until a satisfactory prototype design emerges. The second section describes the prototype system in detail followed by the evaluation results and discussion. Finally, we make some general observations about the nature of analysis and design.

ANALYSIS AND DESIGN

The analysis and design techniques used within this project are an extension of the User Centred Design Methodology developed as part of the PEN&PAD(GP) project [3].

The analysis phase began with an investigation of the current work practices and paper-based systems used by doctors on two elderly care wards. This was performed in an informal manner through interviews, observations, group discussions and examination of the patient records. Having gained some understanding of users recording activities and information requirements, we felt it necessary to formalise our insights in some way which could both serve as a means of communication and dialogue with users and also a starting point for design. We experimented with data flow diagrams and task analysis techniques, but found them both unsatisfactory. Traditional data flow diagrams yield a useful graphical representation of data flows around a system, but provide no explicit portrayal of users tasks. In contrast, task analysis techniques do portray users tasks, but the graphical representation is too simplistic and fails to depict data flows.

We devised a hybrid technique which provides both an explicit representation of users task and maps more closely onto the design process. In Task Oriented Flow Diagrams (TOFD) a clear distinction is drawn between the human task components and system objects. Task components are designated in terms of the professional role, such as doctor or nurse, and have operational and knowledge components, while system objects possess both process and data storage components (Task Oriented Flow Diagrams have been described in detail elsewhere [4]). Our experiences of using TOFDs has been encouraging, as users could quickly relate to the diagrams and readily entered into

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dialogue concerning the accuracy of our perceptions about their work tasks. This dialogue highlighted discrepancies in our understanding and allowed us to gain a better understanding of users tasks, causing us to revise the diagrams several times through negotiation with users. The agreed diagrams were then used as a basis for design, system objects indicating major information concepts to be modelled. Before the prototype was actually built, we produced paper sketches of the proposed interface design which were "story-boarded" with users. Again, discrepancies were highlighted, the work analysis re-examined and the design amended, according to users comments.

During the analysis and design phase described above, it was necessary to decide what the goals of our first prototype would be. Our initial intension was to explore the overall structure and information content of the system, not to tackle the data entry. Thus, we concentrated upon the conceptualisation and retrieval of information.

THE DOCTOR'S PROTOTYPE

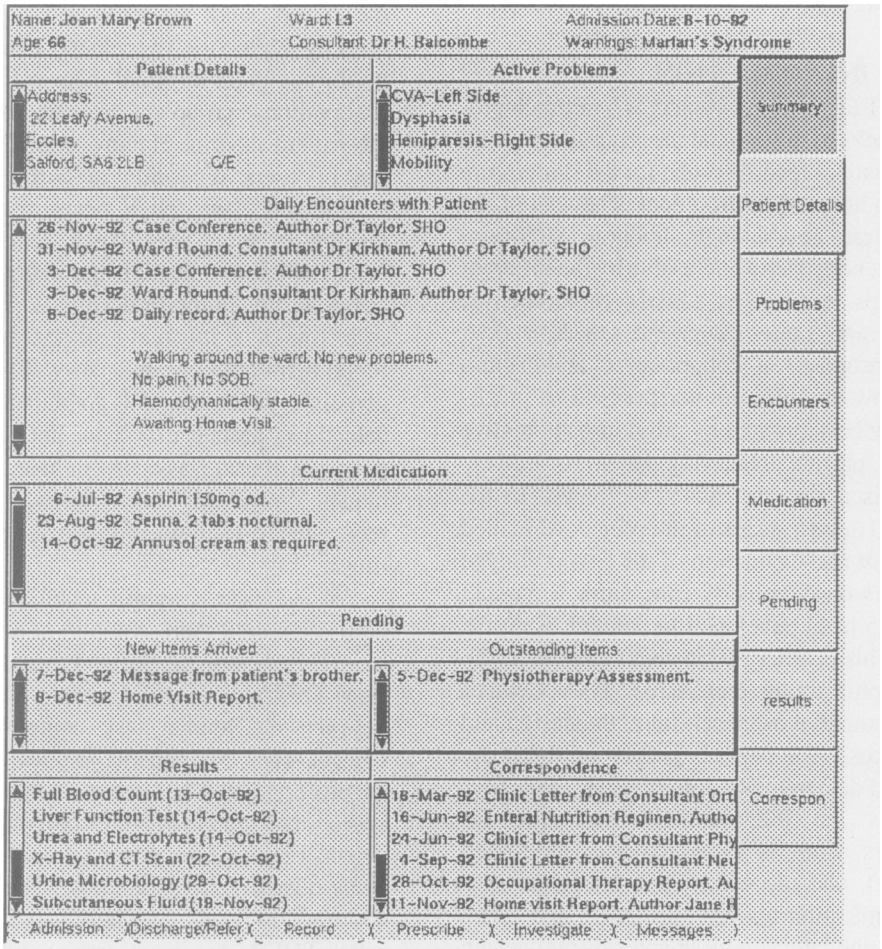
As there is insufficient space in this paper to fully describe all aspects of the prototype, we will concentrate on the general metaphor which is used, the method of accessing information, and three important components of the system:

The Folder Metaphore

The overall metaphor upon which the system is based is that of a folder (similar to an A4 ring binder), in which each section or page is delineated by the use of dividers and is accessed via tabs (one per page) aligned along the right hand side of the page. This is a direct representation of the patient record folders used in the elderly care ward. All interaction with the system is achieved by pointing and clicking with a mouse.

Folding Lists

The concept of a Folding List reflects the nature of hospital records i.e. a chronological list of entries each attributed with an author, time and date, place



An example of a PEN&PAD (Elderly Care) data entry form. The Summary Sheet.

and set of observations about the patient. Each entry is represented by two parts. The "headline" gives a date and time when the entry was made, the type of entry, a key phrase that indicates the contents or subject of the entry, and the author of that entry. The "body" is simply the text contained in the entry. The entries are initially displayed as a chronological list of headlines with the most recent entry at the bottom of the page. Users can access the text contained within a headline by clicking on that headline with the mouse ("expanding" an entry). Likewise, an entry can be "folded" by clicking a second time on it's headline. These "Folding Lists" are used throughout the system for all types of record entries.

There are potentially vast numbers of entries in the hospital record of an elderly patient. This can cause problems for a doctor attempting to move around the record or locate a specific piece of information. Summarisation of entries through the generation of headlines which contain key words, helps reduce the problem of data management and also assists with navigation.

The Summary Page

The Summary Page is initially displayed as the topmost sheet of the folder. It has two purposes. Firstly, it is intended to provide an overview of the structure and contents of the record for navigation purposes. Secondly, it is intended to act as an adjunct to the routine daily care of the patient by providing instant access to relevant information.

The Summary Page is divided into panes each of which corresponds directly to a page contained within the record, and displays some of the data to be found on that page. This may be either the most recent information from that page, or a summarised version. For example, the Clinical History Notes Pane corresponds to a page contained within the record, and displays the last few entries made in the record (the most recent being in an "expanded" form). The Problems Page contains a list of both active and inactive problems, however, the Summary Pane corresponding to this page displays only the active problems as these are more pertinent to daily care of the patient.

While the majority of the pages in the system have a direct equivalent in the paper-based record, we added the new concept of a Pending Page. This provides the doctor with a quick reminder about new information that has arrived or outstanding items requested.

The Encounters Page

This page is simply a Folding List of all entries made to the Clinical History Notes during the current episode of care. However, as there are potentially vast numbers of entries made to a patient's record during a single hospital visit, this list may become unwieldy and difficult to navigate around. Therefore, some simple navigation aids were included, in the form of buttons which move the current focus to the first entry in the list, the last entry in the list, back a page, forward a page, forward to the next entry and back to the previous entry. These navigation buttons are included on all Folding Lists.

The Problems Page

This is divided into two sections. The top section contains two panes, one listing the active problems and the other the inactive problems. Below there is a Folding List of all entries to the Patient Record (not just the current episode of care) including GP referral letters, clinic letters and specialist reports. By selecting a problem, either active or inactive, the list of entries in the bottom section is filtered according to the selected problem. For example, if the problem dysphasia is selected, then only those entries which contain information relevant to the problem dysphasia would be listed. This facility provides a means of accessing information concerning past problems. There is also a facility to move problems either from active to inactive, or vice versa from inactive to active. This supports the problem oriented approach used on the ward.

The Pending Page

This page is intended to provide a quick reminder of new results or reports that have arrived since the patient was last seen, and outstanding items which have not yet arrived. Once read an item can be filed away in the record.

EVALUATION OF THE PROTOTYPE

The evaluation had two purposes. Firstly, to make an initial assessment of whether the prototype system would be at all useful and usable in daily practice on the ward, and secondly to give users an idea of the possible advantages and implications of a computer-based approach. Such a small scale prototype cannot be more fully evaluated as its functionality is limited and covers only one patient's data. At this preliminary stage, we as designers seek to check our current ideas before continuing to the next stage of development.

The evaluation consisted of the following stages:

User Training

The first part of training involves the evaluator giving a demonstration of the system to the user, complemented by commentary and explanations. The user is then allowed to use the system to complete several training tasks. The evaluator provides assistance as necessary. Once the users feel sufficiently comfortable about using the system as expected in a limited amount of time, they continue with the actual evaluation section.

Evaluation Scenarios

The user is asked to carry out a set of tasks, reading them from a paper script, without the aid of the evaluator if possible. These tasks are based around real situations that may arise on the ward. For example, one scenario asked the doctor to look at the Problem Page and ascertain whether the patient had ever suffered from haemorrhoids, and if so to find out when and where they were treated. Different tasks were devised to test different aspects of the system. The user was asked to transcribe their answers on the evaluation sheet.

Observations

We observed the users carrying out the evaluation scenarios and made notes of any problems encountered or items of interest that occurred.

Questionnaires

The users were asked to complete two sections of a questionnaire. The first section (completed before training) asked about general computer experience and attitudes to computerised patient records. The second section, (completed after the evaluation scenarios) asked about specific aspects of the system, such as how easy it was to obtain a particular item of information, as well as more general questions about the users reaction to the system.

Discussion Group

After all the doctors had carried out the evaluation exercises, a discussion group was held which gave users a chance to offer their opinions in a less structured manner. It also enabled the group of designers and users together to discuss future directions of the project.

THE RESULTS

Observations of Users

Despite the fact that several of the users had never used a computer before or were unfamiliar with a mouse and graphical interfaces, all those who took part in the evaluation found it fairly easy to use the system almost immediately. They all appeared to grasp the key concepts quickly and could navigate around the system with ease. The Folder metaphor was easily recognised. Although some users initially found the Folding Lists somewhat difficult to understand, they became more comfortable with the idea as the evaluation proceeded.

Questionnaires

The questionnaire wad divided into five sections; Summary Sheet, Encounters Page, Problems Page, Pending Page and overall impressions. The majority of the questions asked about ease of use, or usefulness of information with responses in the range "very good/good/average/poor/very poor". The users ratings for all sections was consistently in the "very good/ good" range. Users were particularly enthusiastic about the "Pending Page" as there is no direct equivalent in the paper-based system. The only area of some disagreement was the Summary Sheet. Although most users rated the Problems Pane and Pending Pane as "very useful" there were mixed responses to the other components of the Summary Sheet. The Encounters Pane component of the Summary Sheet was seen as of as "average" usefulness, as was Results and Correspondence Panes (this is discussed below). Items that users requested that had been omitted from the Summary Sheet included date of birth(in addition to age which is already present), hospital number, admission source, past admissions, and some indication of the long term plan for the patient.

Discussion Group

The discussion group highlighted an inconsistency in the design metaphor. We had confused two separate roles in the Summary Page. Firstly, we designed it to function as a navigation tool, showing the user what the contents of the folder are, rather like the list of contents in a book, and how to get to them. However, we also designed it to to function as a daily work summary, showing specific patient information which is pertinent to daily care and providing a means of monitoring both the arrival of new information and outstanding reports and tests ordered.

This inconsistency accounts for the mixed questionnaire ratings given to the usefulness of the Results Pane, Correspondence Pane and Encounters Pane, as part of the Summary Pane. Some users viewed the Summary Page as a navigation aid and so scored all the panes as useful. Those users who saw the Summary Page as an aid memoir to daily care thought that new or changing data was most important. Consequently these users gave high scores to the Pending Pane and Problem Pane, but gave lower scores to the other panes, which they saw as obscuring more relevant information.

As an aid to daily care, the role of the Summary Page differs between the different doctor roles. For example, a consultant seeing a patient on a ward round requires a different summary from that of a Senior House Officer carrying out daily care of the patient. Furthermore, individuals requested the ability to tailor the Summary Page to meet their own specific needs and preferences.

The discussion group also considered the future direction of the work. The prototype had adequately illustrated to users the potential of a computer-based approach for them to be willing to invest further effort in the design process. However, it had to be explained that any system providing the data manipulation facil-

ities of the prototype would require some sort of structured data entry. Once this was understood, it was readily agreed that the next step would be to look at the problem of data entry. The PEN\&PAD (GP) project has developed and successfully tested a data entry technique named "Predictive Data Entry" which is based upon an underlying semantic network representation of medical terminology. We intend to assess the suitability of this technique for hospital based care.

DISCUSSION

Analysis and design is a difficult task. Without close involvement of potential users in the process, the resulting system will inevitably impose the designers conceptions and ideas upon the users. In particular, the problem as perceived by the designers may not be that actually experienced by the users[5]. Designers often have preset ideas and favourite techniques they wish to explore, thus the whole design process may become solution led rather than problem led. However, when users become closely involved in the design of a prototype such as this paper describes, they often expect to be delivered a fully working system at the end of the project, especially if the prototypes they see appear fully functional despite being purely mocked-up. This problem of "managing users expectations"[6] should not be overlooked, and we have sought to convince our users that while this work will not directly result in a fully operational system, it will hopefully influence the future of such systems.

On a wider scale, this project seeks to investigate the requirements of an integrated patient record system which is to be shared by all the disciplines involved in hospital-based care of the elderly. The aim is to support the distinct professional roles and working practices of these groups through different views on a common underlying patient record. In pursuit of this goal we have also developed a nursing record system which provides a nursing view on the patient record, yet shares data with the doctors system (reported in [2]). The nursing system is based upon the same metaphor as the doctors system, consisting of a Folder which includes a Patient Details Page, Communications Page, Progress and Evaluations Page, Care Plan Page, Medication Page, Results Page, Doctor's Encounters Page and Summary Page (three of these pages are shared with the doctor's system). The nursing system also uses Folding Lists to represent entries in the record. While the headlines of the entries in the doctor's system are generally indexed to medical problems, the nursing headlines are indexed to Care Plan items. The nursing prototype has been developed using the User Centred Design Methodology described in this paper, and nurses have been involved throughout the design cycle. It has been evaluated in a similar manner with encouraging results.

The concept of multiple views on a shared patient record is central to this work. We argue that the professional roles of the different user groups must be preserved in the development of a shared record system. User centred Design is important in ensuring that the needs of all user groups are met. The approach used in the PEN&PAD (Elderly Care) project makes the patient and their care central to the record structure, not any individual group's data preferences or perspectives.

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